

CLAIMS

1. A magnetic head using magnetoresistive effect comprising:

a magnetic sensing portion formed of a magnetoresistive effect element, wherein:

said magnetic sensing portion includes a lamination layer structure portion in which at least a free layer made of a soft magnetic material of which the magnetization is rotated in response to an external magnetic field, a fixed layer made of a ferromagnetic material, an antiferromagnetic layer for fixing the magnetization of said fixed layer and a spacer layer interposed between said free layer and said fixed layer are laminated with each other;

said lamination layer structure portion further includes a magnetic flux introducing layer of which the tip end is opposed to a surface which is brought in contact with or opposed to a magnetic recording medium;

said lamination layer structure portion has at its lamination layer direction opposing side surfaces formed of one flat surface or continuous one curved surface over at least said free layer, said spacer layer and said fixed layer;

a hard magnetic layer having high resistance or low resistance for maintaining a magnetic stability of said free layer is disposed in direct contact with said opposing surfaces or through an insulating layer;

a sense current for said lamination layer structure portion flows through the lamination layer direction of said lamination layer structure portion; and

an external magnetic field is applied to the direction extended along the plane direction of said lamination layer structure portion and which is extended substantially along said opposing side surfaces.

2. A magnetic head using magnetoresistive effect comprising:

a magnetic sensing portion formed of a magnetoresistive effect element, wherein:

said magnetic sensing portion includes a lamination layer structure portion in which at least first and second fixed layers made of ferromagnetic materials, first and second antiferromagnetic layers for fixing the magnetizations of said fixed layers and first and second spacer layers interposed between free layers and said first and second fixed layers are laminated with each other across both surfaces of said free layers made of soft magnetic materials of which the magnetizations are rotated in response to an external magnetic field;

said lamination layer structure portion further includes a magnetic flux introducing layer of which the tip end is opposed to a surface which is brought in contact with or opposed to a magnetic recording medium;

said lamination layer structure portion has at its lamination layer direction opposing side surfaces formed of one

flat surface or continuous one curved surface over at least said free layer, said spacer layer and said fixed layer;

a hard magnetic layer having high resistance or low resistance for maintaining a magnetic stability of said free layer is disposed in direct contact with said opposing surfaces or through an insulating layer;

a sense current for said lamination layer structure portion flows through the lamination layer direction of said lamination layer structure portion; and

an external magnetic field is applied to the direction extended along the plane direction of said lamination layer structure portion and which is extended substantially along said opposing side surfaces.

3. A magnetic head using magnetoresistive effect according to claim 1 or 2, wherein said spacer layer is formed of a nonmagnetic conductive layer.

4. A magnetic head using magnetoresistive effect according to claim 1 or 2, wherein said spacer layer is made of a tunnel barrier layer.

5. A magnetic head using magnetoresistive effect according to claim 1 or 2, wherein said hard magnetic layer and said free layer are disposed in such a manner that a central portion in the thickness direction of said hard magnetic layer substantially agrees with a central portion in the thickness direction of said free layer.

6. A magnetic head using magnetoresistive

effect according to claim 1 or 2, wherein said free layer serves as said magnetic flux introducing layer as well.

7. In a method of manufacturing a magnetic head including a magnetic sensing portion formed of a magnetoresistive effect element, a magnetoresistive effect type magnetic head manufacturing method comprising the steps of:

a lamination layer film deposition process in which at least a free layer made of a soft magnetic material of which the magnetization is rotated in response to an external magnetic field, a fixed layer made of a ferromagnetic material, an antiferromagnetic layer for fixing the magnetization of said fixed layer, a magnetic flux introducing layer the tip end of which is opposed to a surface which is brought in contact with or opposed to a magnetic recording medium and a spacer layer interposed between said free layer and said fixed layer are deposited on a substrate to form a lamination layer film deposited film;

a patterning process in which a lamination layer structure portion in which opposing side surfaces are formed of one flat surface or continuous one curved surface is formed by continuously patterning at least said free layer and said fixed layer with the same mask and side end faces of said free layer and said fixed layer are opposed to said side surfaces; and

a process in which hard magnetic layers having high or low resistance for maintaining a magnetic stability of said

free layer are formed in direct contact with said opposing side surfaces or through an insulating layer, wherein a sense current for said lamination layer structure portion is flowing through a lamination layer direction of said lamination layer structure portion and a magnetic sensing portion for applying an external magnetic field in the direction extending along the plane direction of said lamination layer structure portion and in the direction extending substantially along said opposed side surfaces.

8. In a method of manufacturing a magnetic head including a magnetic sensing portion formed of a magnetoresistive effect element, a magnetoresistive effect type magnetic head manufacturing method comprising the steps of:

a film deposition process in which first and second fixed layers made of ferromagnetic materials, first and second antiferromagnetic layers for fixing the magnetizations of said fixed layers, a magnetic flux introducing layer the tip end of which is opposed to a surface which is brought in contact with or opposed to a magnetic recording medium and lamination layer film deposition films of said free layer and first and second spacer layers interposed between said first and second fixed layers are deposited on a substrate at both surfaces of a free layer made of a soft magnetic material the magnetization of which is rotated in response to an external magnetic field;

a patterning process in which a lamination layer structure portion in which opposing side surfaces are formed

of one flat surface or continuos one curved surface is formed by continuously patterning at least said free layer and said fixed layer with the same mask and side end faces of said free layer and said fixed layer are opposed to said side surfaces; and

a process in which hard magnetic layers having high or low resistance for maintaining a magnetic stability of said free layer are formed in direct contact with said opposing side surfaces or through an insulating layer, wherein a sense current for said lamination layer structure portion is flowing through a lamination layer direction of said lamination layer structure portion and a magnetic sensing portion for applying an external magnetic field in the direction extending along the plane direction of said lamination layer structure portion and in the direction extending substantially along said opposed side surfaces.

9. A method of manufacturing a magnetic head using magnetoresistive effect according to claim 7 or 8, wherein said spacer layer is formed of a nonmagnetic conductive layer.

10. A method of manufacturing a magnetic head using magnetoresistive effect according to claim 7 or 8, wherein said spacer layer is comprised of a tunnel barrier layer.

11. A method of manufacturing a magnetic head using magnetoresistive effect according to claim 7 or 8, wherein said hard magnetic layer and said free layer are disposed in such a manner that a central portion in the thickness direction

of said hard magnetic layer agrees substantially with a central portion in the thickness direction of said free layer.

12. A method of manufacturing a magnetic head using magnetoresistive effect according to claim 7 or 8, wherein said free layer is served as said magnetic flux introducing layer as well.